1009型 雙 面 計 算 尺
簡 易 説 明 書

OPERATION INSTRUCTIONS

FOR

DOUBLE FACED SLIDE RULE TYPE 1009

中 華 人 民 共 和 國
上 海 四 達 尺 廠

THE PEOPLE'S REPUBLIC OF CHINA
STANDARD RULE MANUFACTURERS

我厂为适合科学技术人员的使用便利,特设计 1009 型双面计算尺。本尺共有 26 条尺度,内容丰富。其中包括乘除,平方,立方,常用对数,自然对数,三角函数,双曲函数等等尺度。故它对于电工、力学、土木等计算都很方便,因此是广大科学技术人员的良好计算工具。

兹将本尺线条排列和每线条的功用分述于下:

1. 1009 型正面线条有:LLo1、LLo2、LLo3、DF、CF、CIF、L、CI、CD、LL3、LL2、LL1 计 13 条。

2. 1009 型反面线条有:Sh1、Sh2、K、A、B、T、ST、S、C、D、DI、P、Th 计 13 条。

3. 今先将正面各线条的内容按次序分别说明 其 功 用 如下:

A. LLo1、LLo2、LLo3 这三根红字的线条是衔接的,自 .00005 起到 .9905 止,都是代表小于 1 数字的对数值。

B. DF、CF 线条:DF 和 CF 就是 D 尺和 C 尺,不过以"1"刻在中间之区别,起点为 $\sqrt{10}$ 开始。

C. CIF 线条:此线条是 DF、CF 的倒数尺,并与 DF、CF 线相互应用的。

D. L 尺线条:这根线条和 D 尺配合应用的,用来计算对数值的。

E. CI 线条:这根红字 CI 线条是 C、D 尺的倒数尺,其尺度和长度和 C、D 尺同,但其刻划自右到左倒行排列的,此尺为求某数的倒数值,又可作连乘除之用。

F. C、D 线条:此线条为算尺中的基本尺,尤其是计算三角函数离不了此尺,读数到三位准确数又同其他尺度发生关系,因此称为计算尺中的基本尺,其线条的排列和长度二尺相同。

G. LL3、LL2、LL1 线条:这三根黑色自然对数线条亦是衔接的,其刻度自 LL1 的 1.0095 起到 20000 止都是代表大于 1 的对数值。

4．今将反面各线条的功用分迷于下：

A．Sh1、Sh2、Th 线条： 这三根线条都称双曲线线条，Sh1 自 .095 到 .9 止，Sh2 自 .35 到 3 止。Th 自 .095 到∞止。

B．K 尺线条：这根线条是专供计算立方之用，和 D 尺配合运算的。

C．A．B尺线条：这二根线条是刻在一起的， 和C、D 有同等功用，可以计算乘除又可计算乘方及开方之用。

D．S 尺线条：这是一根正弦线条，其角度自5.5°～90°。

E．ST 尺线条及 T 尺线条：

ST 尺是一根正弦和正切的小角度线条， 自 .55°～6° 止。

T 尺是一根正切尺，T 尺线条自 5.5°～45° 止。

F．C、D 线条：此二线条和前面所述的是同一性质的，因便于计算三角函数等的运算特再重复设置的。

G．DI 线条：这根 DI 线条是配合 D 尺求倒数的，同 CI 尺和 C 尺求倒数是同样的， 因便于计算某数的倒数值而重复设置的。

H．P 尺线条：这根尺是按 $\sqrt{1-(.1C)^2}$ 公式刻的，和其它尺的红H相同， 配合 D 尺应用。

5．为了简化说明起见将尺上常用的名称统一规定如下：

各种尺度名为线条，线条二端所划的第一条线名为指标线，在左者称为左指标线，在右者称为右指标线，在尺中可以左右移动者称为滑尺，尺上可以左右移动者称为滑标，滑标上的指示线称为髮线。本尺是二面计算的，其滑标玻璃分为二面，一面玻璃是单根线划在中间，另一面中间一根长线是主线，一根短线在 A、B 尺方面是换算 H. P. 和 K. W. 之用。为了便利运算圆面积之用所以在 A、B 及 C、D 尺上 3.1416 处都刻有 π 记号，在 K 尺 520、530 之间有一 V 记号。它的值为 π/6，为求球体积用的。比方球直径为 8，求体积。先将髮线盖着 K 尺 V．抽

动滑尺，使C尺10也被髮线盖着。再移动髮线到C尺8，就可读得体积K尺268了。球体积为$\frac{\pi}{6}d^3$。

6．今将各线条的应用方法举例于后：

乘法：如欲一数乘他数运用C、D尺，计算方法如下：

例题1　　$8 \times 18 = 144$

解：先以C尺右端10移到D尺上8，再以滑标移置C尺上18，在D尺上读答数144。

例题2　　$4 \times 24 = 96$

解：先以C尺左端1移置在D尺上4，再移滑标到C尺的24，在D尺上读答数96。

再以上述1—2二个算题运用A、B尺计算：

解1　　$4 \times 24 = 96$先以B尺左1移置A尺的4，再移滑标髮线到B尺上24，在A尺上读答数96。

解2　　$8 \times 18 = 144$先以B尺右方100移到A尺左段8，再移滑标到B尺的18，则髮线指在A尺上144即答数。

7．除法：如欲一数被他数所除其运算方法如下：

例题：　　$54 \div 9 = 6$

解：先以运用C、D尺来计算，将滑标髮线移置在D尺上54，再以C尺9移在髮线下和54相对齐，在C尺10指在D尺上6即答数。

再以上述算题用A、B尺来计算：

解：先以滑标线移在A尺（右方）54，再以B尺之9移在髮线下和54相对齐，在B尺左端1指在A尺上6即答数。

8．红CI倒数尺的运用方法：在C尺任何一数的倒数值，可在CI尺上查得之，CI尺位于C尺上方用红色数字以资区别，注意CI尺的数字自右端读到左端的。

例题．求 5 之倒数值，将滑标髮线移动到 C 尺上 5 则髮线
指在 CI 尺上 2 即 5 之倒数值 .2。

用 CI 尺运算乘除法：

例题． $27 \times 31 = 837$

解．先以滑标髮线移在 D 尺上 27，再以 CI 尺的 31 移在 髮
线下与 D 尺 27 相对齐（和经常做乘法方法相反），则
C 尺右端指在 D 尺上 837 即答数。

例题．除法： $54 \div 9 = 6$

解．先以 CI 尺左端 10 移在 D 尺上的 54，再以滑标 髮线
移到 CI 尺的 9，在髮线下读 D 尺 6 即答数（和用 C、D
做除法的方法相反）。

9．DF、CF 及 CIF 三根线条的用法：

例题． $2 \times 3 \times 4 = 24$

解．先以滑标髮线移到 DF 尺的 2，再以左端 CIF 尺的 3 移
在髮线下，再移髮线到 CF 尺的 4，在 DF 尺上找到 24
即答数。

DF、CF 和 CIF 尺可以和 C、D 尺联合运算，如 C、D 尺上
找不到答数，可在 DF、CF 尺上读出之，反之如 DF、CF尺上
找不到答数时，也可在 C、D 尺上求得之。

例题． $4 \times 5 \times 6 = 120$

解．先以滑标髮线移到 DF 尺的 4，再以 CIF 尺的 5 移在
髮线下，此时 4×5 的积(20)在 DF、CF 尺上找不出
来，同时 C 尺的 10 适指在 D 尺 20，即移髮线到 C 尺
6 在 D 尺上读答数 120。

例题． $\dfrac{16}{4 \times 2} = 2$

解．移 CF4 到 DF 的 16（做除法 $16 \div 4$ 的商不用读出），
再移髮线到红 CIF 的 2 做除法，看髮线指在 DF 尺上
的 2 即答数。

10．C、D 和红 CI 尺及 DF、CF 和红 CIF 六尺的联合使用法：

例题：A．求　　$2 \times 8 \times 7 = 112$

解：移动髮线到 D2，抽动滑尺使红 CI8 到髮线下，在红 CI 或 C 尺 1 所指在 D16 是 2×8 之积，但要再乘 7 在 C 尺上是不可能移出，在这情况下要利用 DF、CF 尺，因同时 CF1 亦指在 DF 的 16，就可移动髮线到 CF 的 7，看髮线指在 DF 的 112 即答数。

例题：B．　　$4 \div (8 \times 35) = 0.01428$

解：移动髮线到 DF4，抽动滑尺使 CF8 也被髮线盖着，则 CF1 指在 DF 尺上 5，同时在 C 尺的 10 亦指在 D 尺上 5，在此情况下，可移动髮线到红 DI 的 35 在 D 尺上读得 0.01428。

11．LLo1、LLo2、LLo3 和 LL3、LL2、LL1 六尺的用法：

例题：A．求 1.2^2、1.2^{20}、$1.2^{0.2}$ 用黑自然对数尺 LL3、LL2 及 LL1。

解：移动髮线到 LL2 的 1.2，再将 C 尺左 1 移到髮线下，复移髮线到 C 尺 2，在 LL2 上读 1.44，LL3 上读 38.3，在 LL1 上读 1.0371。

例题：B．求 $e^{-3.92}$、$e^{-0.392}$、$e^{-0.0392}$ 用红自然对数尺 LLo1、LLo2、LLo3。

解：移动滑标髮线到 D 尺的 392，在 LLo3 尺上读 .0198，在 LLo2 尺上读 .676，在 LLo1 尺上读 .9616。

12．L 尺线条：这根线条是用来计算常用对数值，亦就是小数点后的对数数值。

如求 lg3.2，移髮线到 D2 的 32，在 L 尺上读 .505。

如求 lg3，移髮线到 D 尺 3，在 L 尺上读 .477。

13．K 尺线条：此尺是便于计算立方及立方根之用。

如髮线盖着D尺的 4，在K尺上读 64，就是 4^3。

如髮线盖着D尺的 8，在K尺上读 512，就是 8^3。

14．Sh1、Sh2、th 线条的用法：

解：Sh 为 Sinh 的缩写，th 为 tgh 的缩写。

例题：求 Sh.39 和 Sh2.095

解：移髮线到 Sh1 的 0.39，在D尺上读得 0.4。

解：移髮线到 Sh2 的 2.095，在D尺上读得 4。

例题：求 th0.424

解：移髮线到 th 的 0.424、在D尺上读得 0.4。

15．S尺线条：这是一根正弦尺。

例题：求 Sin.30°

解：移髮线到 S尺的 30°，在D尺上读其值为0.5。

16．T 尺线条：

如求 tg30°，tg35°。

解：移髮线到 T.的 30°，在C尺上读 .577，移髮线到 T 的 35°、在C尺上读 0.7。

如求 ctg.40°

解：移髮线到 T尺的 40°（黑），在 DI 尺上读 1.192。这是因为 $tg\alpha \cdot ctg\alpha = 1$ 的原故。

In order to meet the needs of scientists and technicians to solve mathematical problems with ease we have designed a Double Faced Slide Rule Type 1009 provided with 26 scales in total for versatile applications, involving multiplication, division, squares, cubes, common logarithms, natural logarithms, trigonometric functions and hyperbolic functions. The slide rule is therefore very convenient for making computations in connection with electrical, mechanical and civil engineering. Hence it is an ideal calculation tool for scientists and technicians.

The scale arrangement of the slide rule and the application of every scale are described as follows:

1. On the front face of the slide rule type 1009, the scales are:

LLo1, LLo2, LLo3, DF, CF, CIF, L, CI, C, D, LL3, LL2, LL1; in total 13 scales.

2. On the back face of the slide rule type 1009, the scales are:

Sh1, Sh2, K, A, B, T, ST, S, C, D, DI, P, Th; in total 13 scales.

3. The scales on the front face are now described in order as follows:

   A. Three scales marked red, LLo1, LLo2 and LLo3 form a continuous scale, ranging from .00005 to .9905. These numbers represent the logarithms of numbers less than 1.

   B. DF and CF scales: DF and CF scales are graduated exactly like D and C scales respectively, but with "1" at middle and $\sqrt{10}$ at starting point.

   C. CIF scale: This scale is the reciprocal scale of scales DF & CF and can be used in conjunction with scales DF & CF.

D.   L scale: This scale is used together with D scale for finding the logarithm of a number.

E.   CI scale: This red CI scale is the reciprocal scale of scales C & D and is graduated exactly like C & D scales, but with graduations running in reverse direction, i.e. from right to left. It is used for reading the reciprocals and is also useful for successive multiplications and divisions.

F.   C & D scales: These scales are generally used for multiplication and division with readings correct up to three figures. They are also related with the other scales and are hence called the basic scales of the slide rule. The graduations and the length of these two scales are exactly the same.

G.   LL3, LL2 and LL1 scales: These three black natural logarithm scales also form a continuous scale, ranging from 1.0095 to 20000. These numbers represent the logarithm of numbers greater than 1.

4.   The scales on the back face are described as follows:

A.   Sh1, Sh2 and Th scales: These three scales are all called hyperbolic scales, Sh1 from .095 to .9, Sh2 from .35 to 3, Th from .095 to ∞.

B.   K scale: This scale is used in conjunction with D scale for cubing a number.

C.   A and B scales: A and B scales are two identical scales and adjacent to each other. They serve the same purpose as scales C & D and can be used for multiplication and division as well as for squaring and finding square root of a number.

D. S scale: This is a scale of sines for angles from 5.5° to 90°.

E. ST and T scales: ST scale is a scale of sines and tangents of small angles from .55° to 6°. T scale is a scale of tangents for angles from 5.5° to 45°.

F. C and D scales: These two scales are exactly like the scales C & D on the front face and they are repeated on the back face in order to facilitate calculation of trigonometric functions, etc.

G. DI scale: DI scale is used in conjunction with scale D for finding reciprocals and serves the same purpose as the scale CI on the front face.

H. P scale: This scale is engraved according to $\sqrt{1-(0.1C)^2}$ and is used in conjunction with scale D.

5. For the sake of simplicity in explanation certain terms in connection with the slide rule are named as follows:

Graduations on the slide rule are called the scales, both end lines of every scale are the index lines, the left one of which is the left index and the right one the right index, the moving strip of the slide rule is the slide, the moving part on the side rule is the cursor and the indicating line on the cursor is the hairline. Since this slide rule is of double face type, the cursor has two glasses, one each on its front and back sides respectively, the front one has a hairline in the middle and the back one has a long hairline in the middle and a short hairline used for converting H.P. to K.W. and vice versa. In order to facilitate calculation of area of circle, 3.1416 on scales A, B & C, D is marked with π. The constant $\pi/6$ used for finding volume of sphere is marked with V between 520 and 530 on scale K, e.g. if diameter of sphere is 8, the

volume of sphere can be found by first setting the hairline over V on K, next shifting the slide to set the right index (10) of C below the hairline and then setting the hairline over 8 on C, whereby the volume 268 can be read on K below the hairline. The formula of the volume of sphere being $\frac{\pi}{6}$ d³.

6. The uses of various scales are as follows:

Multiplication: For multiplying one number by another use scales C & D as in the following examples.

Example 1: $8 \times 18 = 144$

First set the right index (10) of C opposite 8 on D, next set the hairline over 18 on C and then read 144, the answer, on D below the hairline.

Example 2: $4 \times 24 = 96$

First set the left index (1) of C opposite 4 on D, next set the hairline over 24 on C and then read 96, the answer, on D below the hairline.

The above 2 examples can also be computed by using scales A & B.

To multiply 4×24, first set the left index (1) of B opposite 4 on A, next set the hairline over 24 on B and then read 96, the answer, on A below the hairline.

To multiply 8×18, first set the right index 100 of B opposite 8 on A, next set the hairline over 18 on B and then read 144, the answer, on A below the hairline.

7. For dividing a number by another the operations are carried out as follows:

Example: $54 \div 9 = 6$

When using scales C & D, set the hairline over 54 on D and shift the slide to have 9 on C set below the hairline.

Then opposite the right index (10) of C read 6, the answer, on D. When using scales A & B, shift the cursor to have the hairline set over 54 on right part of A and set 9 on B below the hairline. Then opposite the left index (1) of B read 6, the answer, on A.

8. Use of red CI reciprocal scale: The reciprocal of any number on scale C can be found on scale CI. The scale CI is located above the scale C with red lettering for distinction. Note that the numbers on CI should be read from right to left.

Example: Find the reciprocal of 5. Set the hairline over 5 on C and direct below the hairline read 0.2, the reciprocal of 5, on CI.

Use of CI scale for multiplication and division:

Example: $27 \times 31 = 837$

First set the hairline over 27 on D and set 31 on CI below the hairline, i.e. a multiplication is replaced by a division. Then read 837, the answer, on D opposite the right index of C.

Example: $54 \div 9 = 6$

First set the left index (10) of CI opposite 54 on D and set the hairline over 9 on CI, i.e. a division is replaced by a multiplication. Then below the hairline read 6, the answer, on D.

9. Use of three scales DF, CF & CIF:

Example: $2 \times 3 \times 4 = 24$

Set the hairline over 2 on DF, set 3 on left part of CIF below the hairline and move the cursor to set the hairline over 4 on CF, then below the hairline read 24, the answer, on DF.

Scales DF, CF & CIF can be used in conjunction with scales C & D. If the answer can not be found on the scales C & D, it may be obtained on scales DF & CF. On the contrary, if the answer can not be found on the scales DF & CF, it may be obtained on the scales D & C.

Example: $4 \times 5 \times 6 = 120$

Set the hairline over 4 on DF and set 5 on CIF below the hairline. At this time the product of 4×5 (20) can not be found on scales DF & CF, but it can be obtained on D opposite the right index (10) of C. Then set the hairline over 6 on C and below the hairline read 120, the answer, on D.

Example: $\dfrac{16}{4 \times 2} = 2$

Set the hairline over 16 on DF and set 4 on CF below the hairline. At this time there is no need to read the quotient of $\dfrac{16}{4}$. Now set the hairline over 2 on CIF and read 2, the answer, on DF below the hairline.

10. Combined use of six scales C, D, red CI, DF, CF and red CIF.

Example A: $2 \times 8 \times 7 = 112$

Set the hairline over 2 on D, shift the slide to set 8 on red CI below the hairline and opposite 1 on red CI or C find 16, the product of 2×8, on D. Now it is impossible to move the cursor to 7 on C for further multiplication because 7 lies beyond the extremity of D. In such a case scales DF & CF are to be used for the purpose because at this time 1 on CF also points at 16 on DF. Then move the cursor to set the hairline over 7 on CF and read 112, the answer, on DF below the hairline.

Example B: $4 \div (8 \times 35) = 0.01428$

Set the hairline over 4 on DF, move the slide to set 8 on CF below the hairline and find 5 on DF opposite 1 on CF. At the same time the right index (10) of C also points at 5 on D. In such a case move the cursor to set the hairline over 35 on red CI, and read 0.01428, the answer, on D below the hairline.

11. Use of Six scales LLo1, LLo2, LLo3 & LL3, LL2, LL1:

Example A: Find 1.2^2, 1.2^{20} & $1.2^{0.2}$ by using natural logarithmic scales LL3, LL2 & LL1.

Set the hairline over 1.2 on LL2, move the slide to set the left index (1) of C below the hairline and set the hairline over 2 on C. Then read 1.44 on LL2, 38.3 on LL3 and 1.0371 on LL1 below the hairline.

Example B: Find $e^{-3.92}$, $e^{-0.392}$, $e^{-0.0392}$ by using red scales LLo1, LLo2 & LLo3.

Set the hairline over 392 on D and read 0.0198 on LLo3, 0.676 on LLo2 and 0.9616 on LLo1 below the hairline.

12. L scale: This scale is used for finding the common logarithm of a number, i.e. the mantissa of the logarithm.

For finding lg3.2 set the hairline over 32 on D and read 0.505 on L below the hairline.

For finding lg3 set the hairline over 3 on D and read 0.477 on L below the hairline.

13. K scale: This scale is used for cubing a number and finding the cube root of a number.

By setting the hairline over 4 on D find 64 on K, i.e. 4 below the hairline.

By setting the hairline over 8 on D find 512 on K, i.e. 8^3 below the hairline.

14. Use of scales Sh1, Sh2 & Th: Sh is the abbreviation of Sinh and Th is the abbreviation of tgh.

Example: Find Sh 0.39 and Sh 2.095.

Set the hairline over 0.39 on Sh1 and read 0.4 on D below the hairline.

Set the hairline over 2.095 on Sh2 and read 4 on D below the hairline.

Example: Find Th 0.424.

Set the hairline over 0.424 on Th and read 0.4 on D below the hairline.

15. S scale: This scale is a scale of sines.

Example: Find Sin 30°.

Set the hairline over 30° on S and read 0.5, the sine of 30°, on D below the hairline.

16. T scale: This scale is a scale of tangents.

Example: Find tg 30° and tg 35°.

Set the hairline over 30° on T and read 0.577, the tangent of 30° on C below the hairline.

Set the hairline over 35° on T and read 0.7, the tangent of 35°, on C below the hairline.

For finding ctg 40°

Set the hairline over 40° (black) on T and read 1.192, the cotangent of 40°, on DI below the hairline, since $tg\,a \times ctg\,a = 1$.